



# SPEC® CPU2017 Floating Point Speed Result

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## NEC Corporation

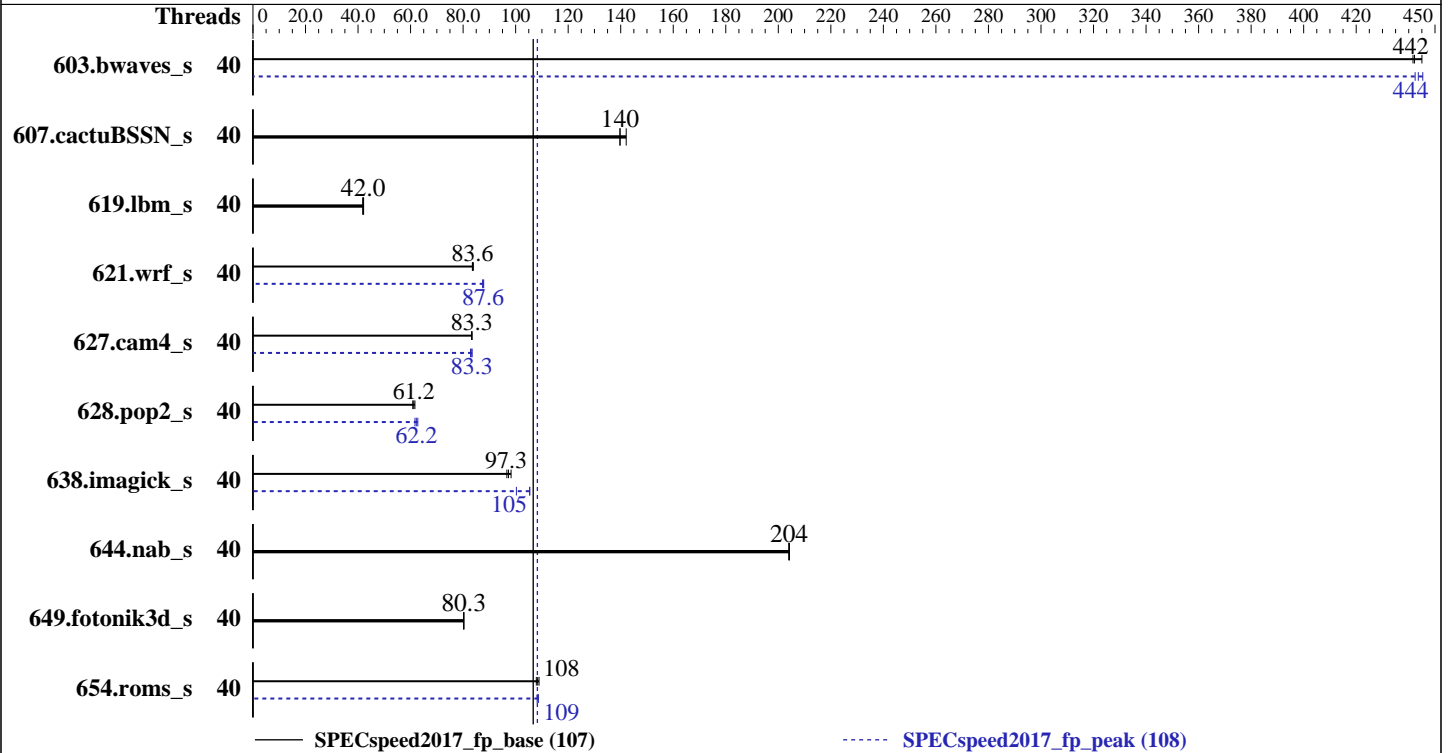
SPECspeed2017\_fp\_base = 107

Express5800/R120h-1E (Intel Xeon Gold 6138)

SPECspeed2017\_fp\_peak = 108

CPU2017 License: 9006  
Test Sponsor: NEC Corporation  
Tested by: NEC Corporation

Test Date: Jan-2019  
Hardware Availability: Nov-2017  
Software Availability: Mar-2018



### Hardware

CPU Name: Intel Xeon Gold 6138  
Max MHz.: 3700  
Nominal: 2000  
Enabled: 40 cores, 2 chips  
Orderable: 1,2 chips  
Cache L1: 32 KB I + 32 KB D on chip per core  
L2: 1 MB I+D on chip per core  
L3: 27.5 MB I+D on chip per chip  
Other: None  
Memory: 192 GB (12 x 16 GB 2Rx8 PC4-2666V-R)  
Storage: 1 x 1 TB SATA, 7200 RPM, RAID 0  
Other: None

### Software

OS: Red Hat Enterprise Linux Server release 7.4 (Maipo)  
Kernel 3.10.0-693.21.1.el7.x86\_64  
Compiler: C/C++: Version 18.0.2.199 of Intel C/C++ Compiler for Linux;  
Fortran: Version 18.0.2.199 of Intel Fortran Compiler for Linux  
Parallel: Yes  
Firmware: NEC BIOS Version U31 06/20/2018 released Sep-2018  
File System: ext4  
System State: Run level 3 (multi-user)  
Base Pointers: 64-bit  
Peak Pointers: 64-bit  
Other: jemalloc memory allocator V5.0.1



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## Results Table

| Benchmark       | Base    |             |             |            |             |            |             | Peak    |             |             |            |             |            |             |
|-----------------|---------|-------------|-------------|------------|-------------|------------|-------------|---------|-------------|-------------|------------|-------------|------------|-------------|
|                 | Threads | Seconds     | Ratio       | Seconds    | Ratio       | Seconds    | Ratio       | Threads | Seconds     | Ratio       | Seconds    | Ratio       | Seconds    | Ratio       |
| 603.bwaves_s    | 40      | 133         | 445         | 134        | 442         | <u>133</u> | <u>442</u>  | 40      | 132         | 445         | <u>133</u> | <u>444</u>  | 133        | 442         |
| 607.cactuBSSN_s | 40      | 119         | 140         | 117        | 142         | <u>119</u> | <u>140</u>  | 40      | 119         | 140         | 117        | 142         | <u>119</u> | <u>140</u>  |
| 619.lbm_s       | 40      | 124         | 42.1        | <u>125</u> | <u>42.0</u> | 125        | 41.8        | 40      | 124         | 42.1        | <u>125</u> | <u>42.0</u> | 125        | 41.8        |
| 621.wrf_s       | 40      | <u>158</u>  | <u>83.6</u> | 158        | 83.5        | 158        | 83.9        | 40      | <u>151</u>  | <u>87.6</u> | 151        | 87.4        | 151        | 87.8        |
| 627.cam4_s      | 40      | <u>106</u>  | <u>83.3</u> | 106        | 83.4        | 106        | 83.3        | 40      | 106         | 83.4        | 107        | 82.8        | <u>106</u> | <u>83.3</u> |
| 628.pop2_s      | 40      | 193         | 61.7        | 195        | 60.8        | <u>194</u> | <u>61.2</u> | 40      | 189         | 62.8        | 193        | 61.7        | <u>191</u> | <u>62.2</u> |
| 638.imagick_s   | 40      | 149         | 96.7        | 147        | 98.3        | <u>148</u> | <u>97.3</u> | 40      | 144         | 100         | 137        | 105         | <u>137</u> | <u>105</u>  |
| 644.nab_s       | 40      | <u>85.6</u> | <u>204</u>  | 85.5       | 204         | 85.7       | 204         | 40      | <u>85.6</u> | <u>204</u>  | 85.5       | 204         | 85.7       | 204         |
| 649.fotonik3d_s | 40      | <u>114</u>  | <u>80.3</u> | 114        | 80.3        | 114        | 80.2        | 40      | <u>114</u>  | <u>80.3</u> | 114        | 80.3        | 114        | 80.2        |
| 654.roms_s      | 40      | 146         | 108         | <u>145</u> | <u>108</u>  | 145        | 109         | 40      | 146         | 108         | 145        | 109         | <u>145</u> | <u>109</u>  |

SPECspeed2017\_fp\_base = 107

SPECspeed2017\_fp\_peak = 108

Results appear in the order in which they were run. Bold underlined text indicates a median measurement.

## Operating System Notes

Stack size set to unlimited using "ulimit -s unlimited"

## General Notes

Environment variables set by runcpu before the start of the run:  
KMP\_AFFINITY = "granularity=fine,compact"  
LD\_LIBRARY\_PATH = "/home/cpu2017/lib/intel64:/home/cpu2017/je5.0.1-64"  
OMP\_STACKSIZE = "192M"

Binaries compiled on a system with 1x Intel Core i7-6700K CPU + 32GB RAM  
memory using Redhat Enterprise Linux 7.5  
Transparent Huge Pages enabled by default  
Prior to runcpu invocation  
Filesystem page cache synced and cleared with:  
sync; echo 3 > /proc/sys/vm/drop\_caches

Yes: The test sponsor attests, as of date of publication, that CVE-2017-5754 (Meltdown) is mitigated in the system as tested and documented.  
Yes: The test sponsor attests, as of date of publication, that CVE-2017-5753 (Spectre variant 1) is mitigated in the system as tested and documented.  
Yes: The test sponsor attests, as of date of publication, that CVE-2017-5715 (Spectre variant 2) is mitigated in the system as tested and documented.

jemalloc, a general purpose malloc implementation  
built with the RedHat Enterprise 7.5, and the system compiler gcc 4.8.5  
sources available from jemalloc.net or <https://github.com/jemalloc/jemalloc/releases>



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**Test Date:** Jan-2019  
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### Platform Notes

#### BIOS Settings:

Thermal Configuration: Maximum Cooling  
Workload Profile: General Peak Frequency Compute  
Intel Hyper-Threading: Disabled  
Memory Patrol Scrubbing: Disabled  
Energy/Performance Bias: Maximum Performance  
LLC Dead Line Allocation: Disabled  
Workload Profile: Custom  
NUMA Group Size Optimization: Flat  
Adjacent Sector Prefetch: Disabled  
DCU Stream Prefetcher: Disabled  
Sysinfo program /home/cpu2017/bin/sysinfo  
Rev: r5974 of 2018-05-19 9bcde8f2999c33d61f64985e45859ea9  
running on r120hle Sat Jan 19 00:09:40 2019

SUT (System Under Test) info as seen by some common utilities.  
For more information on this section, see  
<https://www.spec.org/cpu2017/Docs/config.html#sysinfo>

#### From /proc/cpuinfo

```
model name : Intel(R) Xeon(R) Gold 6138 CPU @ 2.00GHz
 2 "physical id"s (chips)
 40 "processors"
cores, siblings (Caution: counting these is hw and system dependent. The following
excerpts from /proc/cpuinfo might not be reliable. Use with caution.)
cpu cores : 20
siblings : 20
physical 0: cores 0 1 2 3 4 8 9 10 11 12 16 17 18 19 20 24 25 26 27 28
physical 1: cores 0 1 2 3 4 8 9 10 11 12 16 17 18 19 20 24 25 26 27 28
```

#### From lscpu:

```
Architecture:          x86_64
CPU op-mode(s):        32-bit, 64-bit
Byte Order:             Little Endian
CPU(s):                 40
On-line CPU(s) list:   0-39
Thread(s) per core:    1
Core(s) per socket:    20
Socket(s):              2
NUMA node(s):          2
Vendor ID:              GenuineIntel
CPU family:             6
Model:                  85
Model name:             Intel(R) Xeon(R) Gold 6138 CPU @ 2.00GHz
Stepping:               4
CPU MHz:                2000.000
BogoMIPS:               4000.00
```

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### Platform Notes (Continued)

```

Virtualization:      VT-x
L1d cache:          32K
L1i cache:          32K
L2 cache:           1024K
L3 cache:           28160K
NUMA node0 CPU(s): 0-19
NUMA node1 CPU(s): 20-39
Flags:              fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov
pat pse36 clflush dts acpi mmx fxsr sse sse2 ss ht tm pbe syscall nx pdpe1gb rdtscp
lm constant_tsc art arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc
aperfmpperf eagerfpu pni pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3 fma
cx16 xtpr pdcm pcid dca sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes
xsave avx f16c rdrand lahf_lm abm 3dnowprefetch epb cat_l3 cdp_l3 invpcid_single
intel_pt spec_ctrl ibpb_support tpr_shadow vnmi flexpriority ept vpid fsgsbase
tsc_adjust bmi1 hle avx2 smep bmi2 erms invpcid rtm cqm mpx rdt_a avx512f avx512dq
rdseed adx smap clflushopt clwb avx512cd avx512bw avx512vl xsaveopt xsavec xgetbv1
cqm_llc cqm_occup_llc cqm_mbm_total cqm_mbm_local dtherm ida arat pln pts

```

```

/proc/cpuinfo cache data
cache size : 28160 KB

```

From numactl --hardware WARNING: a numactl 'node' might or might not correspond to a physical chip.

```

available: 2 nodes (0-1)
node 0 cpus: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
node 0 size: 97952 MB
node 0 free: 95430 MB
node 1 cpus: 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39
node 1 size: 98303 MB
node 1 free: 95792 MB
node distances:
node 0 1
0: 10 21
1: 21 10

```

```

From /proc/meminfo
MemTotal:      197735616 kB
HugePages_Total:      0
Hugepagesize:    2048 kB

```

```

From /etc/*release* /etc/*version*
os-release:
NAME="Red Hat Enterprise Linux Server"
VERSION="7.4 (Maipo)"
ID="rhel"
ID_LIKE="fedora"
VARIANT="Server"

```

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### Platform Notes (Continued)

```
VARIANT_ID="server"
VERSION_ID="7.4"
PRETTY_NAME="Red Hat Enterprise Linux Server 7.4 (Maipo)"
redhat-release: Red Hat Enterprise Linux Server release 7.4 (Maipo)
system-release: Red Hat Enterprise Linux Server release 7.4 (Maipo)
system-release-cpe: cpe:/o:redhat:enterprise_linux:7.4:ga:server
```

```
uname -a:
Linux rl20hle 3.10.0-693.21.1.el7.x86_64 #1 SMP Fri Feb 23 18:54:16 UTC 2018 x86_64
x86_64 x86_64 GNU/Linux
```

Kernel self-reported vulnerability status:

```
CVE-2017-5754 (Meltdown):          Mitigation: PTI
CVE-2017-5753 (Spectre variant 1): Mitigation: Load fences
CVE-2017-5715 (Spectre variant 2): Mitigation: IBRS (kernel)
```

```
run-level 3 Jan 19 00:04
```

```
SPEC is set to: /home/cpu2017
Filesystem      Type  Size  Used Avail Use% Mounted on
/dev/sda3        ext4  909G  350G  513G  41% /
```

Additional information from dmidecode follows. WARNING: Use caution when you interpret this section. The 'dmidecode' program reads system data which is "intended to allow hardware to be accurately determined", but the intent may not be met, as there are frequent changes to hardware, firmware, and the "DMTF SMBIOS" standard.

```
BIOS NEC U31 06/20/2018
Memory:
4x UNKNOWN NOT AVAILABLE
12x UNKNOWN NOT AVAILABLE 16 GB 2 rank 2666
```

(End of data from sysinfo program)

### Compiler Version Notes

```
=====
CC 619.lbm_s(base) 638.imagick_s(base, peak) 644.nab_s(base, peak)
-----
icc (ICC) 18.0.2 20180210
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.
-----
CC 619.lbm_s(peak)
-----
```

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### Compiler Version Notes (Continued)

icc (ICC) 18.0.2 20180210  
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.

=====  
FC 607.cactuBSSN\_s(base, peak)

=====  
icpc (ICC) 18.0.2 20180210  
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.  
icc (ICC) 18.0.2 20180210  
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.  
ifort (IFORT) 18.0.2 20180210  
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.

=====  
FC 603.bwaves\_s(base) 649.fotonik3d\_s(base) 654.roms\_s(base, peak)

=====  
ifort (IFORT) 18.0.2 20180210  
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.

=====  
FC 603.bwaves\_s(peak) 649.fotonik3d\_s(peak)  
=====  
ifort (IFORT) 18.0.2 20180210  
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.

=====  
CC 621.wrf\_s(base) 627.cam4\_s(base, peak) 628.pop2\_s(base)  
=====  
ifort (IFORT) 18.0.2 20180210  
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.  
icc (ICC) 18.0.2 20180210  
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.

=====  
CC 621.wrf\_s(peak) 628.pop2\_s(peak)  
=====  
ifort (IFORT) 18.0.2 20180210  
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.  
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## Base Compiler Invocation

C benchmarks:

```
icc -m64 -std=c11
```

Fortran benchmarks:

```
ifort -m64
```

Benchmarks using both Fortran and C:

```
ifort -m64 icc -m64 -std=c11
```

Benchmarks using Fortran, C, and C++:

```
icpc -m64 icc -m64 -std=c11 ifort -m64
```

## Base Portability Flags

```
603.bwaves_s: -DSPEC_LP64
```

```
607.cactuBSSN_s: -DSPEC_LP64
```

```
619.lbm_s: -DSPEC_LP64
```

```
621.wrf_s: -DSPEC_LP64 -DSPEC_CASE_FLAG -convert big_endian
```

```
627.cam4_s: -DSPEC_LP64 -DSPEC_CASE_FLAG
```

```
628.pop2_s: -DSPEC_LP64 -DSPEC_CASE_FLAG -convert big_endian
```

```
-assume byterecl
```

```
638.imagick_s: -DSPEC_LP64
```

```
644.nab_s: -DSPEC_LP64
```

```
649.fotonik3d_s: -DSPEC_LP64
```

```
654.roms_s: -DSPEC_LP64
```

## Base Optimization Flags

C benchmarks:

```
-Wl,-z,muldefs -xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch  
-ffinite-math-only -qopt-mem-layout-trans=3 -qopenmp -DSPEC_OPENMP  
-L/usr/local/je5.0.1-64/lib -ljemalloc
```

Fortran benchmarks:

```
-Wl,-z,muldefs -DSPEC_OPENMP -xCORE-AVX2 -ipo -O3 -no-prec-div  
-qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=3 -qopenmp  
-nostandard-realloc-lhs -L/usr/local/je5.0.1-64/lib -ljemalloc
```

Benchmarks using both Fortran and C:

```
-Wl,-z,muldefs -xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch  
-ffinite-math-only -qopt-mem-layout-trans=3 -qopenmp -DSPEC_OPENMP  
-nostandard-realloc-lhs -L/usr/local/je5.0.1-64/lib -ljemalloc
```

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## Base Optimization Flags (Continued)

Benchmarks using Fortran, C, and C++:

```
-Wl,-z,muldefs -xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch  
-ffinite-math-only -qopt-mem-layout-trans=3 -qopenmp -DSPEC_OPENMP  
-nostandard-realloc-lhs -L/usr/local/je5.0.1-64/lib -ljemalloc
```

## Peak Compiler Invocation

C benchmarks:

```
icc -m64 -std=c11
```

Fortran benchmarks:

```
ifort -m64
```

Benchmarks using both Fortran and C:

```
ifort -m64 icc -m64 -std=c11
```

Benchmarks using Fortran, C, and C++:

```
icpc -m64 icc -m64 -std=c11 ifort -m64
```

## Peak Portability Flags

Same as Base Portability Flags

## Peak Optimization Flags

C benchmarks:

```
619.lbm_s: basepeak = yes
```

```
638.imagick_s: -xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch  
-ffinite-math-only -qopt-mem-layout-trans=3 -qopenmp  
-DSPEC_OPENMP
```

```
644.nab_s: basepeak = yes
```

Fortran benchmarks:

(Continued on next page)





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## Peak Optimization Flags (Continued)

603.bwaves\_s: -prof-gen(pass 1) -prof-use(pass 2) -DSPEC\_SUPPRESS\_OPENMP  
-DSPEC\_OPENMP -O2 -xCORE-AVX2 -qopt-prefetch -ipo -O3  
-ffinite-math-only -no-prec-div -qopt-mem-layout-trans=3  
-qopenmp -nostandard-realloc-lhs

649.fotonik3d\_s: basepeak = yes

654.roms\_s: -DSPEC\_OPENMP -xCORE-AVX2 -ipo -O3 -no-prec-div  
-qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=3  
-qopenmp -nostandard-realloc-lhs

Benchmarks using both Fortran and C:

621.wrf\_s: -prof-gen(pass 1) -prof-use(pass 2) -O2 -xCORE-AVX2  
-qopt-prefetch -ipo -O3 -ffinite-math-only -no-prec-div  
-qopt-mem-layout-trans=3 -DSPEC\_SUPPRESS\_OPENMP -qopenmp  
-DSPEC\_OPENMP -nostandard-realloc-lhs

627.cam4\_s: -xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch  
-ffinite-math-only -qopt-mem-layout-trans=3 -qopenmp  
-DSPEC\_OPENMP -nostandard-realloc-lhs

628.pop2\_s: Same as 621.wrf\_s

Benchmarks using Fortran, C, and C++:

607.cactuBSSN\_s: basepeak = yes

The flags files that were used to format this result can be browsed at

<http://www.spec.org/cpu2017/flags/Intel-ic18.0-official-linux64.2017-12-21.html>

<http://www.spec.org/cpu2017/flags/NEC-Platform-Settings-V1.2-R120h-RevB.html>

You can also download the XML flags sources by saving the following links:

<http://www.spec.org/cpu2017/flags/Intel-ic18.0-official-linux64.2017-12-21.xml>

<http://www.spec.org/cpu2017/flags/NEC-Platform-Settings-V1.2-R120h-RevB.xml>

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